REMARKS

This is in response to the Office Action dated October 15, 2003. Reconsideration is respectfully requested.

Request for Extension of Time

Applicants request that the period for response be extended three months, from January 15, 2004 to April 15, 2004. A check in the amount of $475 is enclosed to cover the three-month extension fee under 37 CFR 1.17(a)(3).

Request for Continued Examination

Applicants file this reply in conjunction with a Request for Continued Examination (RCE) pursuant to 37 CFR 1.114. A check in the amount of $385 is enclosed to cover the fee for the RCE under 37 CFR 1.17(e).

Summary of Objections to Drawings

The drawings are objected to because they fail to show a three-dimensional map of temperature distribution as recited in Claim 1, and because boxes labeled 4 and 5 are not mentioned in the description.

Applicants provide herewith a new figure, Figure 2, that shows a three-dimensional temperature distribution map. Applicants have also amended the description on page 4 as indicated above to identify box 4 as an "elaboration unit" and box 5 as a "co-ordination unit" as well as Figure 2.

Summary of Claim Rejections

Claims 1-12 are pending, and all are rejected as obvious over the reference entitled "Non-Invasive Measurement of Temperature- Versus-Depth Profile in Biological Systems Using Multiple Frequency- Band Microwave Radiometer System" by Hamamura et al (hereafter "Hamamura et al") in view of "Non-

Invasive Temperature Profiling Using Multi-Frequency Microwave Radiometry in the Presence of Water-Filled Bolus" by Mizushina et al (hereafter "Mizushina et al").

Summary of the Invention

As recited in Claim 1, applicants' invention is an instrument for non-invasive measurement of a three-dimensional temperature distribution throughout a dielectric object, for example, living tissue. The instrument has sensors that measure heat emission power of electromagnetic radiation over a range of wavelengths from radio waves (meter wavelength) to the infrared (micron wavelength - see page 3, line 32). The infrared measurements allow a complete three-dimensional temperature map of the object, including its surface, to be created.

The sensors are mounted on supports and are positionable along pre-established directions to determine the three-dimensional temperature distribution. Also associated with the sensors are a data storage and calculation system which take the temperature measurement data from the sensors and calculate and display the three-dimensional temperature map descriptive of the object.

The Argument

Applicants respectfully traverse all of the rejections, contending that the cited references, Hamamura et al and Mizushina et al, fail to meet the requirements necessary to establish a prima facie case of obviousness. This is demonstrated on a claim-by-claim basis below.

Claim 1

To establish a prima facie case of obviousness, three criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the

knowledge generally available to one of ordinary skill in the art, to modify the reference teachings. Second, there must be a reasonable expectation of success. Third, the prior art reference or references when combined, must teach or suggest all the claim limitations. (MPEP, Section 2143.)

Clearly, the combination of Hammaura et al and Mizushina et al does not teach or suggest all claim limitations as required to support the obviousness rejection. Claim 1 recites measuring the emission power of electromagnetic radiation in a frequency range between radio waves (having wave lengths on the order of a meter) and the infrared, having wavelengths on the order of microns (millionths of a meter). This measurement range is supported on page 3, lines 30-32 of the application. This element, namely, measurement in the infrared, is not taught or suggested in either cited reference. Both Hamamura et al and Mizushina et al teach electromagnetic wave measurements limited to the gigahertz range of frequencies. This is the microwave region of the electromagnetic spectrum (radar) which falls between radio waves and the infrared. The wavelengths of microwaves are about five orders of magnitude larger than the infrared wavelengths as defined in the application and recited in Claim 1. Furthermore, the Examiner admits, on page 4 of the Action, that Mizushina et al fails to take measurements in the infrared range, Mizushina et al, according to the Examiner, using a microwave radiometer to measure the temperature distribution. This is essentially the same range as taught in Hamamura et al, again, many orders of magnitude above the infrared as recite in Claim 1.

Claim 1 also recites that the temperature distribution map is three dimensional. Neither Hamamura et al nor Mizushina et al teaches or suggests a three-dimensional temperature distribution map, the Examiner's remarks to the

contrary notwithstanding. Both references are confined to measuring temperature profiles, i.e., temperature as a function of depth. The references teach measurement of one dimensional, and not three-dimensional temperature distributions.

The Examiner states, on page 4 of the Action, that "Shizuo et al [sic, Mizushina et al] discloses radiometric temperature profiling as three-dimensional map of temperature distribution". There are no Figures 6 and 7 in the Mizushina et al reference. If the Examiner meant the Hamamura et al reference, then Figure 6 shows a temperature profile through the stomach of a rabbit, and not a three-dimensional temperature distribution. Figure 7 of Hamamura et al shows photographs of measurement system hardware and does not disclose any manner of temperature distribution. Applicants respectfully request that the Examiner point out where in the cited references a three-dimensional temperature distribution is shown, taught or suggested, or withdraw the rejection of Claim 1.

Furthermore, because Hamamura et al and Mizushina et al ignore the infrared wavelengths as noted above, it is not possible to obtain a complete three-dimensional temperature profile map of the dielectric object because the surface temperatures are not detected. In fact, Hamamura et al teaches that temperature measurements of the skin layer may be neglected. This is seen in Hamamura et al on pages 214-215, which describes the measurements as being taken for the fat and muscle layers beneath the skin, the antenna being substantially incapable of measuring the skin temperature due to its design.

Claim 1 further recites that the sensors are positionable along pre-established directions in order to determine the three-dimensional temperature distribution map. This is nowhere taught or suggested in either Hamamura et al, or Mizushina et al, and thus, a three-dimensional map would not be possible using the teachings of these references.

As demonstrated in the arguments presented above, the proposed combination of Hamamura et al and Mizshina et al does not teach or suggest all elements recited in Claim 1, and therefore, the cited references cannot properly support a rejection of this claim on the basis of obviousness, the prima facie case not having been properly established.

Claims 2-12 depend, either directly or indirectly upon Claim 1 and should be allowable for the same reasons that Claim 1 is allowable.

Claim 5

Claim 5 recites a method using the apparatus of Claim 1 wherein Fridgholm integrals are used to express temperature distributions. It does not appear that such integrals are used in either Hamamura et al or Mizushina et al, as the integrals are not identified therein. Furthermore, both of these references are confined to temperature versus depth profiles (one dimensional distributions) and would not have need for Fridgholm type methods since a three-dimensional map is not contemplated. Furthermore, the Examiner has not specifically addressed this claim and identified where, in either Hamamura et al or Mizushina et al, Fridgholm integrals are used to express temperature distributions. Applicants respectfully request that the Examiner show where this claim element is taught or suggested or withdraw the rejection of Claim 5.

Claims 10-12

Claims 10-12 recite using Rayleigh-Jeans equations and Fridgholm integrals to reconstruct temperatures at points and determine three-dimensional temperature distributions using Fridgholm equations to link emission intensities to the temperature distribution. This is clearly not taught or suggested in either Hamamura et al or Mizushina et al, and the Examiner has not identified where this step is taught or suggested. Again, applicants respectfully request that the Examiner specifically point out where in the cited references these specific claim elements are taught or suggested or withdraw the rejections.

Claim 13

Newly added Claim 13 is similar to Claim 1 and should be allowable for the same reasons that Claim 1 is allowable.

Summary

Applicants have demonstrated in the arguments presented above that the cited references fail to teach or suggest all claim elements and therefore fail to meet the requirements necessary to establish a prima facie case of obviousness. Applicants contend that the claims are allowable over the cited references and request that the application be passed to issue.

Respectfully submitted,

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